Environmental benefits of utilising *Azolla* biomass from nature-based wastewater treatment

Level: Master

Start: anytime from April 2023

Duration: 5 months (30 EC)

Project form/methods: life cycle assessment, analysis of literature and existing field data

Department(s): Environmental Science, Aquatic Ecology & Environmental Biology

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Background

Wastewater that has been treated in a conventional wastewater treatment plant, still contains high nutrient concentrations (and other contaminants), thereby influencing the natural waterbodies where the water is being discharged into. This leads to eutrophication and an increase in greenhouse gas emissions in these natural waters. A post-treatment step, using aquatic plants like *Azolla,* can improve water conditions, by removing nutrients and carbon, and increasing oxygen availability. This step produces large amounts of *Azolla* biomass. To contribute to a circular economy, and to make sure contaminants and carbon are stored properly, this biomass may be used to produce a range of products including biogas, packaging material, growth media, etc. Beyond the environmental benefits of wastewater treatment itself, biomass utilisation in products could substitute conventional products, thereby avoiding these products' environmental impacts, as well as prevent the Azolla biomass from simply being dumped, releasing methane or contaminants. The size of these environmental benefits is, however, unclear.

Project description

In this project you will look at: 1) what range of products could be produced from Azolla biomass, 2) how large the associated net environmental benefits would be (per unit of water treated or Azolla used), from post-treatment of wastewater to substituting conventional products, and 3) how large these benefits are when this strategy is applied at scale. You will use life-cycle assessment to calculate environmental benefits. You can make use of a recently developed approach (Hanssen & Huijbregts, 2019) that has also been applied to other flows of residual biomass, including from river floodplains (Pfau et al., 2019). The required data will come from experiments conducted within our institute, as part of the Aquafarm project (Aquafarm, 2023), as well as from LCA databases and literature. You will be part of a cooperation between two departments (Environmental Science and the department of Aquatic ecology & Environmental Biology) and produce relevant insights for societal stakeholders, including the waterboards in the Netherlands.

References

Aquafarm (2023). Aquafarm project description. Available online: www.aquafarm.nl [accessed 03-02-2023]

Hanssen, S.V. & Huijbregts, M.A.J. (2019) Assessing the environmental benefits of utilising residual flows. *Resources, Conservation & Recycling* 150, 104433.

Pfau, S.F., Hanssen, S.V., Straatsma, M.W., Koopman, K.R., Leuven, R.S.E.W., Huijbregts, M.A.J. (2019) Life cycle greenhouse gas benefits or burdens of residual biomass from landscape management. *Journal of Cleaner Production* 220, 698-706.